



Restover Truck Stop Groundwater Monitoring, Results of December 2000 Sampling

Abstract

This progress report describes results of groundwater sampling at the Restover Truck Stop in December 2000. Samples were collected from one well (WDOE-6A) in the upper aquifer and analyzed for benzene, toluene, ethylbenzene, and total xylenes (BTEX), as well as total petroleum hydrocarbons as gasoline (TPH-G). All four BTEX compounds were detected in well WDOE-6A with an average total concentration of 218 ug/L. The TPH-G concentration in well WDOE-6A was 7,300 ug/L. Model Toxic Control Act (MTCA) cleanup standards were exceeded in WDOE-6A for benzene, toluene, ethylbenzene, and total xylene, as well as for TPH. Well WDOE-6A continues to have elevated BTEX concentrations.

Waterbody Numbers:

WA-1232184468211GW

WA-13-0030GW (Segment No. 06-13-03GW)

Background

The Washington State Department of Ecology has conducted groundwater sampling at the Restover Truck Stop in Thurston County, Washington from 1987 to the present (Appendix A). To remediate soil and groundwater contamination, an Interim Action consisting of an air sparge/vapor extraction system (VES) was initiated in the summer of 1993. Operation of the VES was terminated in the fall of 1997, since BTEX concentrations had substantially decreased and continued operation of the system was no longer cost efficient. In late 1998 and early 1999, the VES and most of the remaining monitoring wells were decommissioned. Currently the only well being monitored is WDOE-6A (Figure 1).

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E-mail: ecypub@ecy.wa.gov

Phone: (360) 407-7472

Address: PO Box 47600, Olympia WA 98504-7600

Author: Pam Marti

Washington State Department of Ecology

Environmental Assessment Program

Phone: (360) 407-6768

Address: PO Box 47710, Olympia WA 98504-7600

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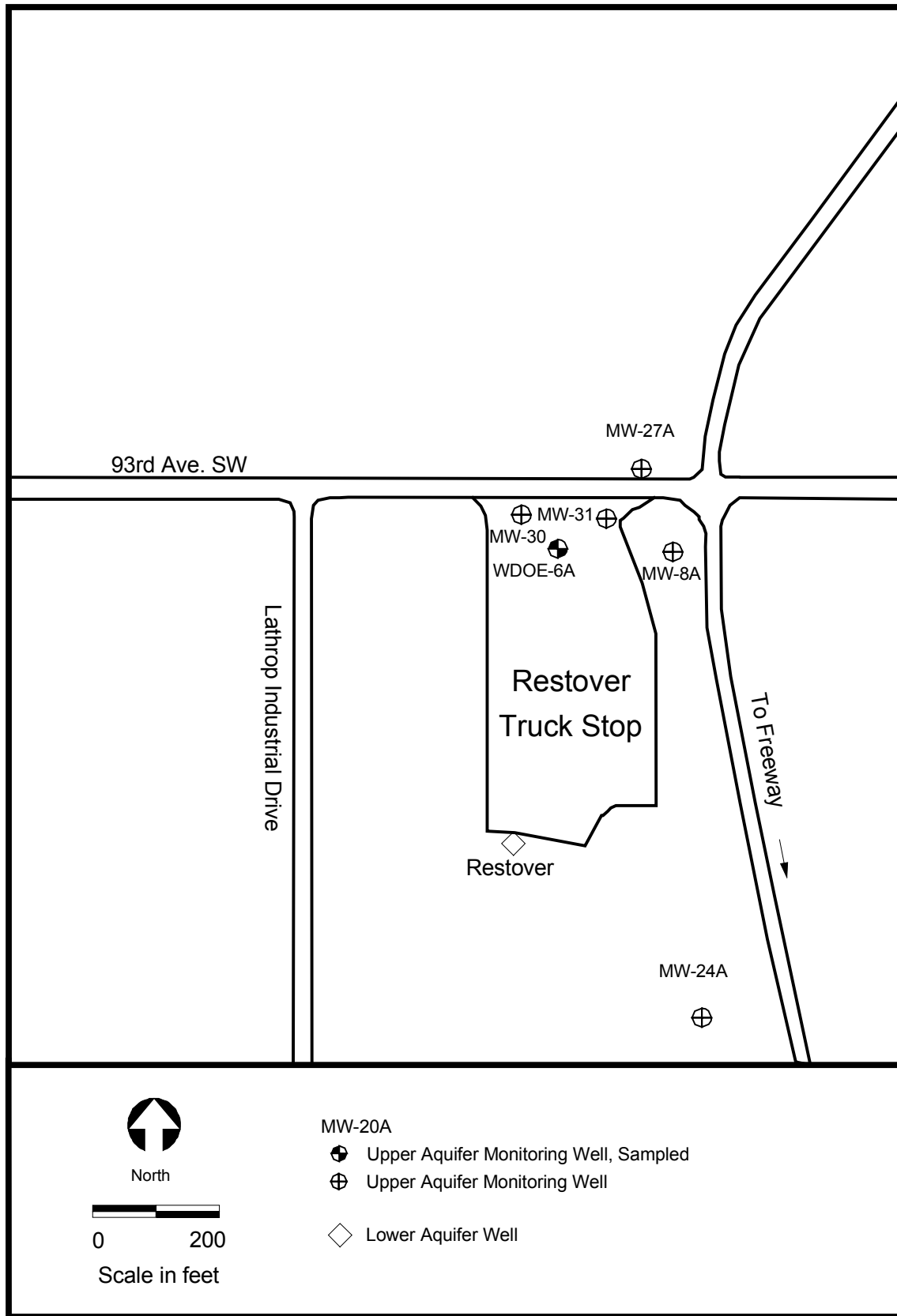


Figure 1: Well Locations, Restover Truck Stop

Methods

Groundwater Sampling

In December, groundwater samples were collected from one upper aquifer monitoring well, WDOE-6A. The upper aquifer consists of recessional outwash. The Vashon Till, which is a regional aquitard, and advance outwash deposits that form a lower aquifer underlie this unit.

Sampling methods were consistent with those previously used on this project. The static water level was recorded prior to well purging. WDOE-6A was purged and sampled with a decontaminated, bottom-emptying teflon bailer. The well was purged until pH, specific conductance, and temperature readings stabilized, and a minimum of three well volumes had been removed. Sampling procedures are discussed in greater detail in Appendix B.

Analysis

Analytes, analytical method, and detection limits are listed for both field and laboratory parameters in Table 1. Monitoring well samples were analyzed for benzene, toluene, ethylbenzene, and xylene (BTEX) as well as total petroleum hydrocarbons as gasoline (TPH-G).

Table 1: Analytical Methods for January 25, 2000 Samples

Analytes	Method	Reference	Detection Limit
Field			
Water Level	Solinst Well Probe	NA	0.01 feet
pH	Orion 25A Field Meter	NA	0.1 Std. Units
Temperature	Orion 25A Field Meter	NA	0.1 C
Specific Conductance	Beckman Conductivity Bridge	NA	10 umhos/cm
Laboratory			
BTEX	SW-846 Method 8260	U.S. EPA 1986	1-5 ug/L
TPH-G	NWTPH-GX	Ecology 1994	0.025 mg/L

In general, the quality of the data is acceptable. Quality control samples collected in the field consisted of a blind field duplicate (MW-6A) for BTEX and TPH-G. The numeric comparison of duplicate results is expressed as the relative percent difference (RPD). The RPD for the December duplicate samples was within 6% for BTEX and 2% for TPH-G. In addition to field quality control samples, method blanks and surrogate compound recoveries were performed in the laboratory. Some of the surrogate recoveries were higher than normal due to the high levels of gasoline in the samples; however, the data were not qualified since they did not affect the results. Quality assurance, as well as laboratory reporting sheets, are presented in Appendix C.

Results

Field Observations

Depth-to-water measurements and purge volume, as well as pH, specific conductance, and temperature readings at the time of sampling, are listed in Table 2.

Table 2: Summary of Field Parameters Results for December 1, 2000

Monitoring Well	Total Depth (feet) ¹	Depth to Water (feet) ²	pH (standard units)	Specific Conductance (umhos/cm)	Temperature (°C)	Purge Volume (gallons)
WDOE-6A	21.68	18.75	6.1	262	13.1	3

¹ Below ground surface.

² Measured from top of casing.

Analytical Results

Analytical results for BTEX and TPH-G from the December sampling, as well as MTCA groundwater cleanup standards, are shown in Table 3.

Table 3: Analytical Results (ug/L) for December 1, 2000

Monitoring Well	Benzene	Toluene	Ethylbenzene	Total Xylene	Total BTEX	TPH-G
MTCA Cleanup Std.	5.0	40.0	30.0	20.0		(Total TPH) 1000.0
WDOE-6A	54	43	38	86	221	7300
MW-6A (dup)*	51	42	37	85	215	7400

* MW-6A is a duplicate sample of WDOE-6A.

In December, all four BTEX compounds were detected in WDOE-6A with an average total concentration of 218 ug/L. The TPH-G concentration in well WDOE-6A averaged 7,350 ug/L.

Table 4 shows BTEX concentrations for select monitoring wells over the entire monitoring period (1987 to 2000). WDOE-6A continues to have BTEX concentrations that consistently exceed MTCA cleanup standards.

Figure 2 shows BTEX concentrations for well WDOE-6A for the entire monitoring period. Historically, concentrations in well WDOE-6A were relatively stable from August 1991 to

February 1995. Since February 1995, BTEX concentrations in well WDOE-6A have been gradually decreasing. In April 1996, high BTEX concentrations were detected in this well. There is no apparent explanation for this increase. The decrease in BTEX concentrations in 1995 coincides with operation of the VES which was initiated in the summer of 1993. Operation of the VES was terminated in the fall of 1997, since BTEX concentrations had substantially decreased. The VES and most of the remaining monitoring wells were decommissioned in the fall of 1998 and early 1999. Beginning in 2001, the monitoring program will be reduced to annual sampling of well WDOE-6A.

Conclusions/Recommendations

1. WDOE-6A continues to have elevated BTEX concentrations. Since 1995, BTEX concentrations in this well have been gradually decreasing. Due to a property transfer, WDOE-6A will continue to be sampled annually for the next few years.
2. In December 2000, Model Toxic Control Act (MTCA) cleanup standards were exceeded in WDOE-6A for benzene, toluene, ethylbenzene, total xylene, and TPH.

References

Ecology, 1994. Manchester Environmental Laboratory - Laboratory Users Manual. Washington State Department of Ecology, Manchester, WA.

U.S. EPA, 1986. Test Methods for Evaluating Solid Waste, SW-846. Office of Emergency Response, U.S. Environmental Protection Agency, Washington, DC.

Table 4: Historical Restover Truck Stop BTEX Concentrations (ug/L) from May 1987 to December 2000

Well Number	May 1987	September 1987	October 1988	January 1989	July 1989	August 1990	February 1991	August 1991	February 1992	July 1992
Upper Aquifer										
WDOE-6A	6950	1180	5300	28000	7490	9870	5190	3460	2840	3830
MW-8A	230 ¹	388 ¹	479 ¹	334 ¹	64 ²	20 ²	178 ²	19 ²	20 ²	9 ²
MW-15A	1433	--	--	ND	218	--	285	122	--	--
MW-17	ND	ND	ND	ND	ND	--	--	ND	ND	--
MW-20A	126	--	--	--	--	20	1400	5	293	11
MW-30	-	-	-	-	-	-	-	-	-	-
MW-9A	727	--	--	--	--	--	--	--	--	--
Lower Aquifer										
Restover	--	--	ND	ND	ND	ND	ND	ND	ND	ND
Spencer	ND	ND	--	ND	ND	ND	ND	ND	ND	ND
MW-12	53	5	8	ND	4	ND	6	ND	--	--

Well Number	January 1993	July 1993	November 1993	January 1994	April 1994	August 1994	November 1994	February 1995	April 1995	August 1995	October 1995
Upper Aquifer											
WDOE-6A	4784	2620	3070	6360	5242	3214	4624	2120	1829	638	646
MW-8A	47 ²	30 ²	41 ²	36 ²	4 ²	8 ¹	32 ²	ND	ND	ND	ND
MW-15A	--	--	--	--	--	--	--	ND	--	2	--
MW-17	ND	--	--	--	--	--	--	--	--	--	--
MW-20A	--(Dry)	162	--(Dry)	ND	59	--(Dry)	ND	ND	ND	18	--(Dry)
MW-30	-	--	--(Dry)	--(Dry)	2400	--(Dry)	--(Dry)	8	8	7	ND
MW-31	-	-	-	-	-	-	-	-	-	--(Dry)	--(Dry)
MW-9A	--	--	--	--(Dry)	366	--	--	ND	--	1	--
Lower Aquifer											
Restover	ND	0.4	--	ND	--	--	--	--	--	ND	--
Spencer	ND	ND	--	--	--	--	--	--	--	--	--
MW-12	--	1.7	--	--	--	--	--	1.1	--	Well Decommissioned	--
MW-12A	-	-	-	-	-	-	-	-	-	0.5	--

ND Compound not detected

-- Compound not tested

¹ Value is based on one sample.

² Value represents the mean of duplicate samples.

Table 4 (continued): Historical Restover Truck Stop BTEX Concentrations (ug/L) from May 1987 to December 2000

Well Number	February 1996	April 1996	August 1996	November 1996	February 1997	August 1997	February 1998	July 1998	January 1999	July 1999	January 2000	December 2000
Upper Aquifer												
WDOE-6A	61	5900	488 ²	664 ²	310 ²	212 ²	214 ²	158 ²	412 ²	92 ²	233 ²	218 ²
MW-8A	ND	ND	ND	5	ND	ND	ND	ND	ND	ND	ND	--
MW-15A	ND	--	--	--	ND	--	--	--	Well Decommissioned	Well Decommissioned		
MW-17	--	--	--	--	--	--	--	--	Well Decommissioned	Well Decommissioned		
MW-20A	ND	ND	1	6	ND	ND	ND	ND	Well Decommissioned	Well Decommissioned		
MW-30	5	19	ND	1	ND	ND	2.5	ND	6.4	ND	11	--
MW-31	7.1	ND	--(Dry)	--(Dry)	ND	3.6	--	--(Dry)	1.1	1.5	ND	--
MW-9A	ND	--	--	--	ND	--	--	--	Well Decommissioned	Well Decommissioned		
Lower Aquifer												
Restover	--	--	--	--	--	--	--	--	--	--	--	--
Spencer	--	--	--	--	--	--	--	--	--	--	--	--
MW-12												
MW-12A	ND	--	--	--	ND	--	--	--	Well Decommissioned	Well Decommissioned		

ND Compound not detected

-- Compound not tested

¹ Value is based on one sample.

² Value represents the mean of duplicate samples.

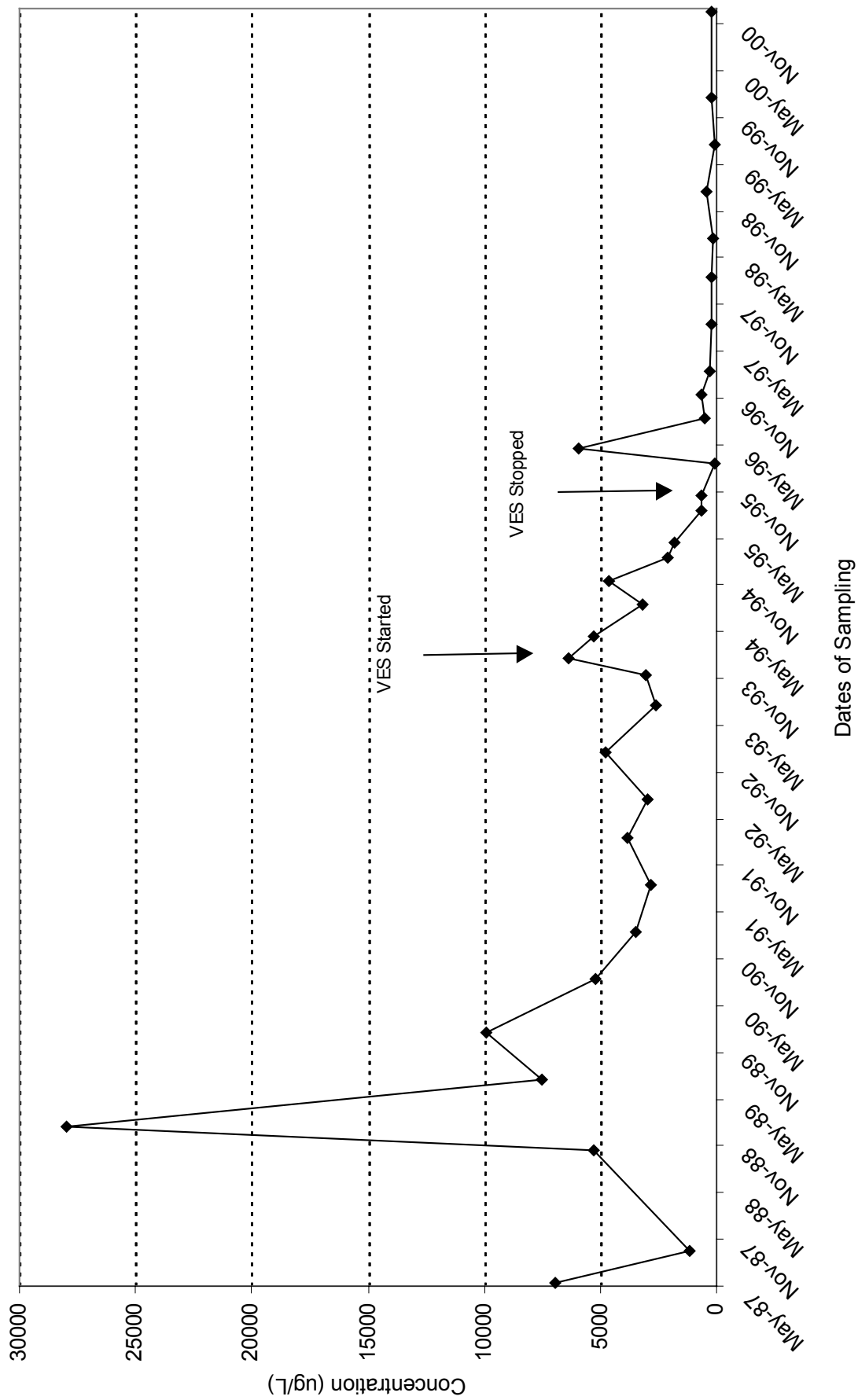


Figure 2: BTEX Concentrations in WDOE-6A from May 1987 to December 2000

Appendix A

Studies at Restover Truck Stop 1987 through 2000

Chern, L., 1988. Sampling at the Restover Truck Stop - October 1988. Department of Ecology, Environmental Investigations.

Chern, L., 1989. Restover Truck Stop Monitoring Round II - January 1989. Department of Ecology, Environmental Investigations.

Chern, L., 1989. Restover Truck Stop Monitoring Round III - July 1989. Department of Ecology, Environmental Investigations.

Chern, L., 1990. Restover Truck Stop Monitoring Round IV - January 1990. Department of Ecology, Environmental Investigations.

Serdar, D. and P. Marti, 1991. Restover Truck Stop Monitoring Round V - August 1990. Department of Ecology, Environmental Investigations.

Marti, P. and D Serdar, 1991. Restover Truck Stop Monitoring Round VI - February 1991. Department of Ecology, Environmental Investigations.

Marti, P., 1992. Restover Truck Stop Monitoring Round VII - August, 1991. Department of Ecology, Environmental Investigations.

Marti, P., 1992. Restover Truck Stop Monitoring Round VIII - February 1992. Department of Ecology, Environmental Investigations.

Marti, P., 1993. Restover Truck Stop Monitoring Round IX - July 1992. Department of Ecology, Environmental Investigations.

Marti, P., 1993. Restover Truck Stop Monitoring Round X - January 1993. Department of Ecology, Environmental Investigations.

Enviros, Inc., 1993. Groundwater Sampling and Analysis Restover Truck Stop Thurston County, Washington. E1/921205.06.

Marti, P., 1994. Restover Truck Stop Monitoring - July and November 1993. Department of Ecology, Environmental Investigations.

Marti, P., 1994. Restover Truck Stop Monitoring - January and April 1994. Department of Ecology, Environmental Investigations.

Marti, P., 1995. Restover Truck Stop Monitoring - August and November 1994. Department of Ecology, Environmental Investigations.

Marti, P., 1995. Restover Truck Stop Monitoring - February and April 1995. Department of Ecology, Environmental Investigations.

Marti, P., 1996. Restover Truck Stop Monitoring - August and October 1995. Department of Ecology, Environmental Investigations.

Marti, P., 1996. Restover Truck Stop Monitoring - February and April 1996. Department of Ecology, Environmental Investigations.

Marti, P., 1996. Restover Truck Stop Monitoring - August and November 1996. Department of Ecology, Environmental Investigations.

Marti, P., 1997. Restover Truck Stop Monitoring - February and August 1997. Department of Ecology, Environmental Investigations.

Marti, P., 1998. Restover Truck Stop Monitoring - February and July 1998. Department of Ecology, Environmental Assessment Program. Pub. No. 98-327.

Marti, P., 1999. Restover Truck Stop Ground Water Monitoring – January and July 1999. Department of Ecology, Environmental Assessment Program. Pub. No. 99-336.

Marti, P., 2000. Restover Truck Stop Ground Water Monitoring, Results for January 2000 Sampling. Department of Ecology, Environmental Assessment Program. Pub. No. 00-03-025.

Appendix B

Groundwater Sampling

In December 2000, samples for benzene, toluene, ethylbenzene, and xylene (BTEX), as well as total petroleum hydrocarbons as gasoline (TPH-G), were collected from one upper aquifer-monitoring well.

Prior to sampling, the static water level was measured using an electronic water level probe. | The probe was rinsed with deionized water and wiped clean between measurements. Well WDOE-6A was purged and sampled using a decontaminated, bottom-emptying teflon bailer. The well was purged until pH, specific conductance, and temperature readings stabilized, and a minimum of three well volumes had been removed. Purge water for WDOE-6A was collected in a 55-gallon barrel and stored with other vapor extraction system waste in the enclosed tank area. This waste will be transported and disposed of in accordance with State of Washington regulations (Chapter 173-340-400 WAC).

The bailer used to sample WDOE-6A was pre-cleaned with sequential washes of Liquinox®, hot tap water, 10% nitric acid, distilled-deionized water, and pesticide-grade acetone. After cleaning, the bailer was air-dried and wrapped in aluminum foil. Samples for BTEX and TPH-G analysis were collected free of headspace and preserved with 1:1 hydrochloric acid.

Chain-of-custody procedures were followed in accordance with Manchester Laboratory protocol (Ecology, 1994). The Ecology/EPA Laboratory in Manchester analyzed all samples.

Appendix C

Quality Assurance

Manchester Environmental Laboratory

7411 Beach Dr E, Port Orchard Washington 98366

CASE NARRATIVE

January 9, 2001

Subject: Restover Truck Stop
Samples: 00488081 - 082
Case No. 449900
Officer: Pam Marti
By: Greg Perez
Organics Analysis Unit

VOLATILE ORGANIC ANALYSIS

SUMMARY:

No difficulties were encountered in the analysis of this sample. The data is usable as qualified.

ANALYTICAL METHODS:

Volatile organic compounds were analyzed using EPA Method 8260 purge-trap procedure with capillary GC/MS analysis. Normal QA/QC procedures were performed on the sample.

BLANKS:

Low levels of certain target compounds were detected in the laboratory blanks. If the concentrations of the compounds in the sample are greater than or equal to five times the concentrations of the compounds in the associated method blank, they are considered native to the sample.

SURROGATES:

Surrogate recoveries were higher than normal for Toluene-D8 and p-BFB because of the high levels of gasoline in the samples. No data was qualified because of this.

HOLDING TIMES:

The sample was analyzed within the recommended holding time.

MATRIX SPIKE AND MATRIX SPIKE DUPLICATE:

No matrix spikes were analyzed with these samples.

DATA QUALIFIER CODES:

- U - The analyte was not detected at or above the reported value.
- J - The analyte was positively identified. The associated numerical value is an estimate.
- UJ - The analyte was not detected at or above the reported estimated result.
- REJ - The data are unusable for all purposes.
- NAF - Not analyzed for.
- N - For organic analytes there is evidence the analyte is present in this sample.
- NJ - There is evidence that the analyte is present. The associated numerical result is an estimate.
- E - This qualifier is used when the concentration of the associated value exceeds the known calibration range.
- bold** - The analyte was present in the sample. (Visual Aid to locate detected compound on report sheet.)

Manchester Environmental Laboratory

7411 Beach Dr E, Port Orchard Washington 98366

CASE NARRATIVE

December 12, 2000

Subject: Restover Truck Stop - 48 Project

Sample(s): 00488081-82

Officer(s): Pam Marti

By: Bob Carrell
Organics Analysis Unit

NWTPH-Gx ANALYSIS

ANALYTICAL METHODS:

Portions of these water samples were purged, the analytes trapped then desorbed and analyzed by capillary gas chromatography using flame ionization detection (GC/FID) following Manchester Laboratory's standard operating procedure for the determination of NWTPH-Gx.

HOLDING TIMES:

All samples were analyzed within the method holding times.

BLANKS:

No petroleum products were detected in the laboratory method blank, hence the blanks demonstrate the system was free from contamination.

SURROGATES:

The 1,4-dibromo-2-methylbenzene and 1,4-difluorobenzene surrogate recoveries were acceptable.

MATRIX SPIKES:

None requested.

LABORATORY DUPLICATE:

The precision between the sample 00488081 and the sample duplicate 00488081 LDP1 was acceptable.

COMMENTS:

The data are useable as qualified.

DATA QUALIFIER CODES

- U - The analyte was not detected at or above the reported result.
- J - The analyte was positively identified. The associated numerical result is an estimate.
- UJ - The analyte was not detected at or above the reported estimated result.
- REJ - The data are unusable for all purposes.
- NAF - Not analyzed for.
- N - For organic analytes there is evidence the analyte is present in this sample.
- NJ - There is evidence that the analyte is present. The associated numerical result is an estimate.
- NC - Not Calculated
- E - This qualifier is used when the concentration of the associated value exceeds the known calibration range.

Laboratory data sheets are available only in printed form.

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